DOCUMENT RESUME

ED 025 944 24 EM 006 969

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Group Use and Other Aspects of Programmed Instruction. Final Report.
Illinois State Univ., Normal.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-5-8470
Pub Date Jul 68
Grant-OEG-3-7-058470-0394
Note-66p.
EDRS Price MF-$0.50 HC-$3.40
Descriptors-*Ability Grouping, Attention Control, Experimental Groups, Feedback, Grouping (Instructional Purposes), *Group Instruction, Health Education, Interaction, *Learning Motivation, Linear Programing, Motivation Techniques, Music Education, *Programed Instruction, Prompting, Reinforcement, *Reinforcers, Response Mode, Vocabulary

The use of group approval as a social reinforcer and related methods in group presentation of programed instruction were investigated in a series of studies. The efficacy of programed instructional materials is frequently limited by their inability to command and maintain adequate attention and motivation. To consider social reinforcement effects available in group procedures, a slide version of a vocabulary program was presented to a study group, and individual students were randomly called upon to respond to different frames. Achievement posttests indicated comparable levels of retention in the study group and a control group which completed individual programs. An application of group methods to the teaching of music fundamentals also obtained comparable retention levels for group and individual presentation methods. The feasibility of using a series of tests to delineate subgroups with homogeneous levels of preprogram knowledge and rates of learning was confirmed in a third study, while two final studies found partial prompting and underlining procedures resulted in no differences in retention when compared to conventional programed methods. Group use of instructional programs was considered well received and effective. (SS)

ED025944

FINAL REPORT
Project No. 5-8470-2-12-1
Grant No. OEC-3-7-058470-0394

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Office of Education
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Group Use and Other Aspects of Programmed Instruction

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July 1968

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

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Preface

The studies in this report are presented in chronological order. The first study has been accepted for publication in Programmed Learning and Educational Technology (Britian). Two others are being considered for publication. With the exception of one study, all of the articles deal with the group use of programmed materials.

THE GROUP USE OF PROGRAMMED INSTRUCTIONAL MATERIALS[1]

Curtis Hulteen and Robert Crist

Programmed instructional materials are not living up to their initial promises (Homme, 1964; Vol Janin, 1966). Early hopes were to individualize instruction by allowing students to progress at their own rate, and to keep them attentive through the reinforcing effects of knowledge of results (KR). However, in the typical classroom, the students have difficulty in maintaining such attention, and the most frequent complaint of programmed textbooks is that they represent a "boring way to learn" (Gotkin, 1963).

Existing programmed instructional materials could be used more effectively if an extra-program reinforcer were available to maintain student attention and effort (Homme, 1964; Cress, 1966). One such reinforcer might be group approval. Skinner (1953) and Lundin (1961) suggest that group approval is a readily available and acceptable classroom reinforcer. To use group approval as an extra-program reinforcer it is necessary to use programmed materials under group conditions as opposed to the more customary individual, self-paced condition.

Regarding the group use of programmed materials, little research is reported. Frye (1963) used programs under group conditions and found them effective when the groups were academically homogeneous.

Carpenter and Greenhill (1963) compared pre-pacing and self-pacing of programmed materials using different media of presentation. No significant differences were found between the various media and their data indicate that programmed material can be used under group conditions without significant losses in retention. In both of the above studies, students read the programmed materials but did not make an overt, verbal response in front of the other group members.

[1] PROGRAMMED LEARNING & EDUCATIONAL TECHNOLOGY, 1968. In Press.

This study's purpose was to determine whether group approval was an effective reinforcer in maintaining the attention and effort of students while reading programmed materials when they are flashed on a screen and students required to respond overtly in the presence of the group.

Materials

The programmed text used in this study was Programed Vocabulary by James I. Brown. The program had 34 chapters, each of which contained from 25 to 28 frames. The tests covering the program were taken from the teacher's manual and measured primarily the factual material on prefixes and roots. Tests were given immediately after the completion of a segment of five chapters on the first 30 chapters and also after the final four chapters. A second classroom of less able Ss was also used thus providing replicative data. Both classrooms had 28 Ss who were randomly assigned to one of two groups.

Procedure

Two study conditions were investigated, projector and textbook. Under the projector condition, Ss were required to read the frames as they were projected on a screen. Ss then took turns responding aloud in the presence of the group. The KR was not flashed on the screen until the S called upon emitted a response or said, "I don't know" out loud in front of the group. To keep Ss attentive they were called upon in a random order. Thus, a given S would not know precisely when he would be called upon. To determine the approximate time interval necessary for Ss to read a frame, E read the frames slowly to himself. After this interval the S's name was called out and he was required to make the verbal response.

Textbook Ss read Programed Vocabulary at their desks at a rate they themselves selected. They were told to raise their hands after reading the material, at which time E would collect the books. There were no attempts to use aversive controls such as criticism and frequent warnings to pay attention. All Ss were told they would not be graded on the material. The classroom teacher and E divided their time monitoring the two conditions. Tests were noncumulative, measuring only the material in chapters read after the preceding test.

After Ss were randomly assigned to groups, a pretest was given to determine comparability of groups. A posttest over the 34 chapters was also given. The pretest and posttest were identical. Ss also completed an attitude questionnaire and a sentence completion form. The latter was administered on two separate occasions: in the middle of the study and again at the end.

Individual frames from Programed Vocabulary were re-typed and photographed on 8mm color film. The projector used to display the frames was the recently developed Technicolor 200, 8mm Instant Movie Projector. This projector had two advantages. First, its design enabled E to project one frame at a time onto the screen, thus giving KR immediately upon emission of S's verbal response. The other advantage was that it uses economical 8mm film and a 4000 frame roll costs only $3.00. The group condition will be referred to hereafter as the projector condition. (The condition under which Ss read the textbook individually will be referred to as the textbook condition.)

Subjects

Ss were 56 eighth-grade students (mean age 13.2) in two Language Arts classes in a local school system. The school groups students and places them

in one of five tracks primarily on the basis of mental ability tests. Students in Track One are highest in ability, while those in Track Five are lowest. One classroom at the Track Two level and another at the Track Four were used in this study.

Groups alternated between textbook and projector conditions as shown in Table 1. The purpose of the alternations was to obtain a series of comparisons of the two conditions rather than just one overall comparison. In Track Two, Group A read the first five chapters in the projector condition while Group B read the same five chapters in the textbook condition, individually at their desks. Over all, Group A read nineteen chapters with the projector and fifteen chapters with the textbook. Group B read fifteen chapters with the projector and nineteen chapters with the textbook. Ss were tested upon completion of Chapters 5, 10, 15, 20, 25, 30, and 34.

Ss worked each school day for 50 minutes. This was the time they normally met for their Language Arts class. The study lasted for a total of fifteen days.

Results - Track Two

Two measures were used to determine the initial comparability of the randomly generated groups. On the 34 item pretest, the means for Group A and Group B were 6.7 (SD=2.3) and 5.5 (SD=2.5), respectively. The mean difference of 1.2 points was not significant at the .05 level. These low scores coupled with the small difference suggest the groups were comparable and were equally uninformed of prefixes and roots in Programed Vocabulary.

The other measure of initial group comparability was scores on the California Test of Mental Maturity (CTMM). Group A having a mean of 117.5 (SD=9.9) and Group B having a mean of 118.6 (SD=8.5). The 1.1 difference between means was not significant at the .05 level.

Tests of Retention

Table 1 shows the means, standard deviations, differences in mean scores, and *t* ratios on seven tests of retention for the two study conditions--projector and textbook.

TABLE 1

MEANS, STANDARD DEVIATIONS, AND *t* RATIOS FOR THE TWO STUDY CONDITIONS ON TESTS OF RETENTION

	TRACK TWO						
Tests	1	2	3	4	5	6	7
Items	15	25	15	16	15	15	14
Projector M	12.4[a]	21.8	9.6	13.3	8.4	10.5	8.6
S.D.	1.8	1.4	2.3	1.8	3.1	1.6	.4
Textbook M	12.2	20.1	11.6	12.8	8.3	10.1	8.0
S.D.	1.8	2.3	1.5	2.0	1.6	2.2	.4
Mean Difference	.2	1.7	-2.0	.5	.1	.4	.6
t-Ratio	.29	2.00[b]	2.44[c]	.66	.35	.80	.13

[a]Group A means are underlined
[b]Significant beyond .05
[c]Significant beyond .02

On test one, which had fifteen test items, the projector group mean was 12.4 and the textbook group mean was 12.2. The difference was not significant at the .05 level. On test two the mean difference of 1.7 points indicated that the projector Ss scored significantly ($P<.05$) higher than the textbook Ss. On test three the difference (2.0) was significant ($P<.02$) with the textbook group

having the higher mean. On tests four, five, six, and seven the difference between means did not approach the .05 significance level. Projector and textbook means on tests five, six, and seven show that those tests were the most difficult.

In summary, projector means were higher than the textbook means on six of the seven tests. Of the two significant differences, one favored the projector condition ($P<.05$) and the other favored the textbook condition ($P<.02$).

Posttest Results

The posttest covered material over all 34 chapters and was given on the final day of the study. Table 2 shows the means and standard deviations of the words learned under the two study conditions for Track Two.

Because one prefix had two meanings and appeared twice on the 34 item pretest it was deleted from the 33 item posttest. Of those 33 items Group A read 18 with the projector and 15 with the textbook; whereas, Group B read 18 with the textbook and 15 with the projector.

On the 18 items shown on the left of Table 2, the project mean was 7.7 and the textbook mean was 11.8. This difference of 3.8 was highly significant ($P<.01$) indicating that Ss studying under the textbook condition retained a greater amount of the program than did Ss who read the same material under the projector conditions.

TABLE 2

SUBJECTS' RETENTION UNDER THE TWO-STUDY CONDITIONS
ON THE 33 ITEM POSTTEST

	TRACK TWO							
	Group	No. of Items	M	SD	Group	No. of Items	M	SD
Projector	A	18	7.7	2.2	B	15	7.1	2.6
Textbook	B	18	11.5	2.7	A	15	7.3	2.0
Mean Difference			-3.8				-0.2	

On the other fifteen posttest items in Table 2, the means for Groups A (projector) and B (textbook) were 7.3 and 7.1, respectively. The mean difference did not approach significance at the .05 level.

Reading Time

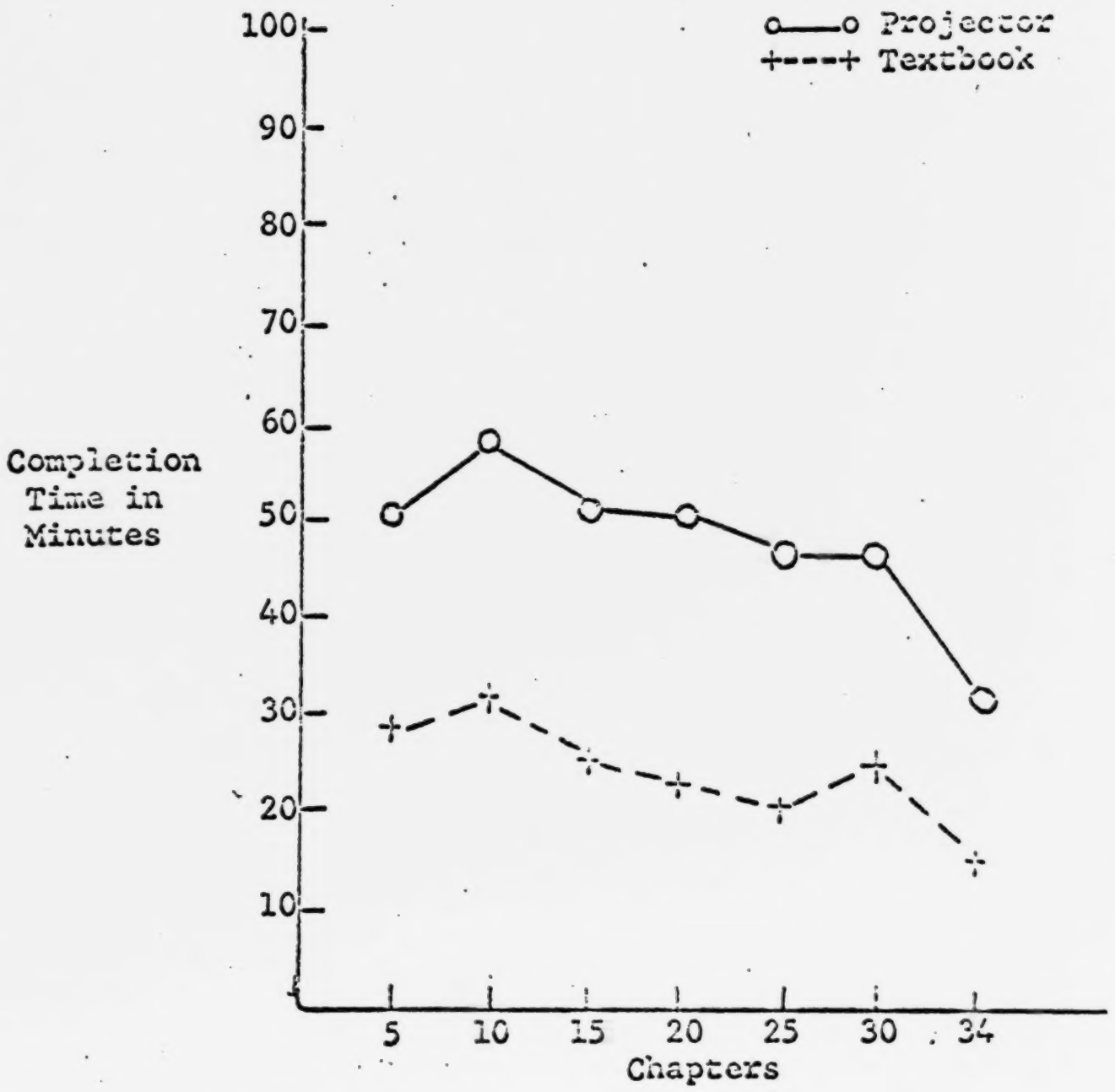
Time for projector and textbook Ss to complete the required chapters is shown in Figure 1. The mean time to complete five chapters with the projector was 50 minutes or about 10 minutes per chapter. Time data indicate that it took projector Ss almost twice as long to complete the same material as textbook Ss.

Results - Track Four Classroom

Track Four Ss provided replicative data. The Track Four classroom (N=28) was randomly divided into groups C and D. On the pretest the two groups had identical means of 2.2, indicating only a slight knowledge of the program's prefixes and roots. On the CTMM, Group C had a mean of 101.2 while Group D had a mean of 106.8.

FIGURE 1

COMPLETION TIME FOR TRACK TWO SUBJECTS UNDER THE TWO STUDY CONDITIONS



Tests of Retention

Table 3 shows the means, standard deviations, mean differences, and the t ratios testing group differences. The means for Track Four were considerably lower than the means for Track Two. The one mean difference found significant ($P < .02$) was on test six. The difference favored the projector condition.

TABLE 3

MEANS, STANDARD DEVIATIONS, AND t-RATIOS FOR THE TWO-STUDY CONDITIONS ON TESTS OF RETENTION

	TRACK FOUR						
Tests	1	2	3	4	5	6	7
Items	15	25	15	16	15	15	14
Projector	10.0[a]	15.1	8.8	10.0	4.5	6.7	4.5
S.D.	3.2	3.4	1.8	3.4	2.8	3.4	2.1
Textbook	9.6	16.5	8.3	10.8	3.9	5.5	5.3
S.D.	3.0	5.0	2.4	3.7	2.7	2.8	2.1
Mean Difference	.4	-1.4	.5	-.8	.6	1.2	-.8
t-Ratio	.10	.98	.60	.15	.33	3.00[b]	.95

[a] Group C means are underlined
[b] Significant beyond .02

Posttest Results

On the posttest, the small mean differences of 0.7 and 0.8 indicate that no differential influences can be attributed to the two study conditions. The low means which are shown in Table 4 also indicate that Ss in Track 4 learned much less than Track 2 Ss.

TABLE 4

SUBJECT' RETENTION UNDER THE TWO-STUDY CONDITIONS
ON THE 33 ITEM POSTTEST

TRACK FOUR

	Group	No. of Items	M	SD	Group	No. of Items	M	SD
Projector	C	18	4.6	1.9	D	15	3.9	2.2
Textbook	D	18	5.3	3.2	C	15	3.1	1.6
Mean Difference			-.7				0.8	

Reading Time

Time data in Figure 2 indicate that it took projector Ss almost twice as long to complete the same material as textbook Ss.

Discussion

This study sought to determine the effects of an extra-programmed reinforcer, group approval, in maintaining attention and effort when reading programmed materials.

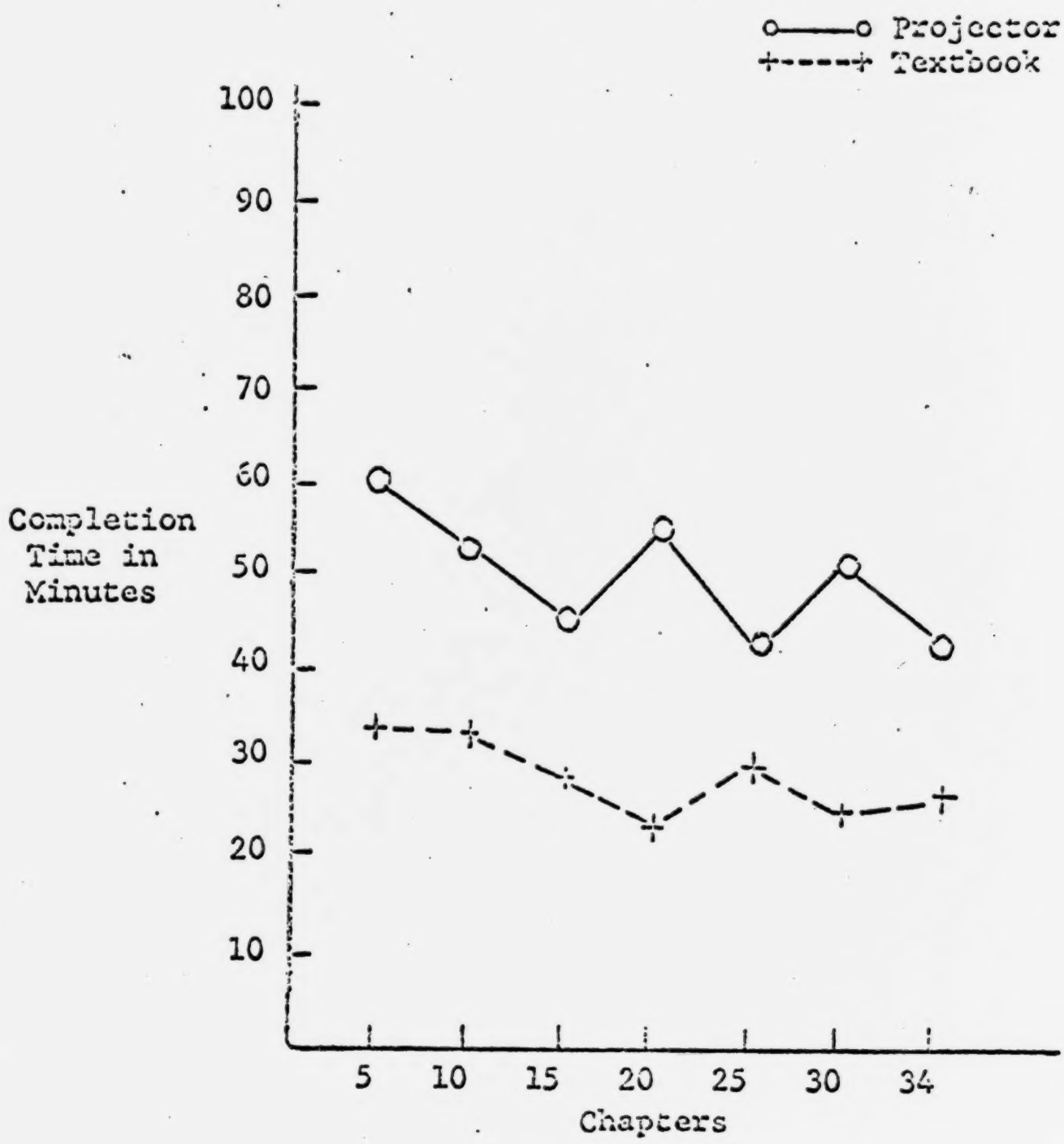
The Ss alternated between two study conditions: projector and textbook. Projector Ss were required to emit a verbal response to a programmed frame or say, "I don't know" in the presence of the group. Textbook Ss read a programmed textbook at a rate they themselves selected.

The results indicate that Ss learned the material as well under the projector (or group) condition as they did when they read the textbook individually at their desks. Time data clearly favored the textbook condition.

The reason why the projector condition took so much time was obvious: before an S gave a verbal response he wanted to be sure he was correct and re-read the material until he was confident he was going to be correct.

FIGURE 2

COMPLETION TIME FOR TRACK FOUR SUBJECTS UNDER THE TWO STUDY CONDITIONS



Although three of the fourteen differences between projector means and textbook means were significant ($P<.05$), no clearly discernible evidence was obtained which indicated the definite superiority of one method over the other.

Although the writers were quite satisfied with the projector study condition, several defects must be remedied if it is to be maximally effective. First, the programmed material must be cumulative. If each program frame has sufficient prompts that an S can make a response without having read the preceding frames, then the Ss are not going to be completely attentive to any frame other than those which they are required to respond overtly. Programed Vocabulary had too many frames that stood alone. A given S could daydream through preceding frames and still find sufficient prompts in a frame to enable him to respond successfully.

A second necessity is to place some pressure on the Ss so that they don't begin reading the frame after they are called upon. When an S is called upon he should be required to respond immediately. Re-reading of the program frames by the responding S was another factor that caused the projector condition to require about twice as much time as the textbook condition. During this re-reading interval, other Ss tended to get irritated. During the projector condition there should be a prepacing to which Ss must gear themselves. Unfortunately in this study, the Ss set the pace and that pace was obviously too slow.

The programmed material must be at a level suitable for the Ss. The basic premise regarding the projector or group condition was that the low error rate characteristic of linear programs would ensure a successful response by an attentive S. Failure to respond, on the other hand, would reflect an inattentiveness, causing that S to suffer other aversive consequences that accompany failure to respond correctly.

Track Four Ss were clearly unequipped for Programed Vocabulary. Although no records of error were maintained, the error rate during the projector condition was in the neighborhood of 75 percent. Saying "I don't know" became so frequent that Ss appeared quite willing to make that response.

Recommendations for Further Research

As a result of this experiment, the following recommendations are made for further research:

1. In comparing projector and textbook conditions, more consideration should be given to controlling the amount of study and review during the textbook condition. This could be done by using a teaching machine which would preclude re-examining the frames.
2. Short frames of less than ten words per frame would be recommended during the projector condition in order to get more responding and thus help Ss to keep attentive.
3. Names of projector Ss should be called out at random. This will maximize attention and effort, since Ss will not know when they are to be called upon to respond.
4. The program itself should be cumulative; Ss must read the previous frames in order to respond correctly when they are ultimately called upon.
5. The material used should be closely adapted to the S's reading skills and present knowledge; his behavioral repertoire should be such as to enable Ss to respond correctly. The difference in performance between Track Two and Track Four Ss indicate that the publishers of programs should be more specific in describing the skills necessary for satisfactory completion of the program. The less able Track Four Ss were clearly unequipped to read and respond to the program.

6. A study should be made in which Ss are given a limited time to make a response after they are called upon. They should not be permitted to read the frame after their name is called out. When their name is called, they should be required to respond immediately.

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UNDERLINING KEY WORDS AS A RESPONSE MODE IN THE USE OF PROGRAMMED MATERIALS

Specialists (Holland, 1965; Markle, 1964; Skinner, 1965) in programmed instruction say that successful responding to program blanks should be based upon having read and responded to all parts of the program frame. Recent research by Holland (1965) has shown that only one-third of a typical program frame need be read in order for the student to make the preferred response. It might be possible to derive greater value from programs if increased efforts were taken to require S to read and examine the total frame.

One method for increasing mastery of conventional textbook material is to have students "underline significant words and phrases" (Crow and Crow, 1963). This method can be especially effective if students are able to discriminate and select the important words or phrases.

In this study a conventional linear programmed text was retyped with the blanks filled in. The students were instructed to read that completed frame and underline the word or phrase which they felt represented the main theme or idea of the frame. The effectiveness of this method was evaluated by comparing it with the performance of a group of students reading the programmed textbook and responding covertly.

METHOD

Subject

The Ss were 22 fifth-graders in a self-contained rural classroom. The school groups students into high and low ability groups. The one used in this first study was the low ability group. Their mean on the Lorge-Thorndike was 105.6 (SD=8.1). Students were randomly assigned to one of two groups: Groups A or B. One group read the same program,

except that their program had the answer i.e., preferred response, typed on it. The condition which required Ss to underline the key words, will be referred to hereafter as the SA (supplied answer) condition. The other will be referred to as the TB (textbook) condition.

The study was replicated with the other 5th grade within the same school. The second classroom (N=19) was composed of higher ability students, and their mean on the Lorge-Thorndike was 118.6 (SD=8.2).

Learning Material

The programmed text Westward Expansion of Our Nation (Coronet Films) was used in this study. It has ten sets (chapters) and 317 frames. The tests measuring retention covered the factual content of the program. The test, given after completion of two sets, were non-cummulative and covered only the material in the two preceding sets.

Procedure

Each of the two groups within a classroom was alternately exposed to the SA and TB conditions. The purposes in alternately exposing the groups to the two conditions were twofold. First, with only 22 Ss it is possible to generate two initially unequal groups. Alternate exposure to the two study conditions would provide a measure of any initial inequality, especially if one group consistently did better. A second advantage is that one overall evaluation at the end of the study provides only one assessment of the two study conditions. Alternating groups after two sets made it possible to obtain five measures of the two conditions.

Under the TB condition Ss read the programmed text Westward Expansion of Our Nation at their desks at their own rate. At the same

time the other group read dittoed copies of the program which contained the frames with the blanks filled in. They were instructed to critically examine and underline the word or words which they felt represented the main theme of each frame. They were not given any knowledge of results or informed in any way as to whether they had underlined the most important words. As soon as an S finished two sets, he took a test and changed to the other study condition. On the final two sets Ss were allowed to select the condition they most preferred: they could read either the programmed text, or the completed frames which required them to underline the key word(s).

Results

Figure 1 shows the mean percentage of correct responses for the lower ability classroom with whom the study was first conducted. On the first test the SA mean was greater than the TB mean, but on the following tests the TB mean was consistently greater than that of the SA group. None of the mean differences shown in Figure 1 approached statistical significance. Following the fourth test all Ss were given the choice of reading the final two sets under either of the two conditions. Since only two of 22 Ss selected the SA condition, the scores on test five are not shown in Figure 1.

Time data for the lower ability group indicated that the underlining of key words took longer for each of the sets, although the differences were slight. The TB mean was 11.6 minutes per set; the SA mean was 12.9 minutes per set.

Figure 2 shows percentage of correct responses for the higher ability classroom with whom the study was replicated. On the first

FIGURE 1

COMPARISON OF TEXTBOOK (TB) CONDITION AND SUPPLIED ANSWER (SA) CONDITION ON FOUR TESTS OF RETENTION
(Low Ability Group)

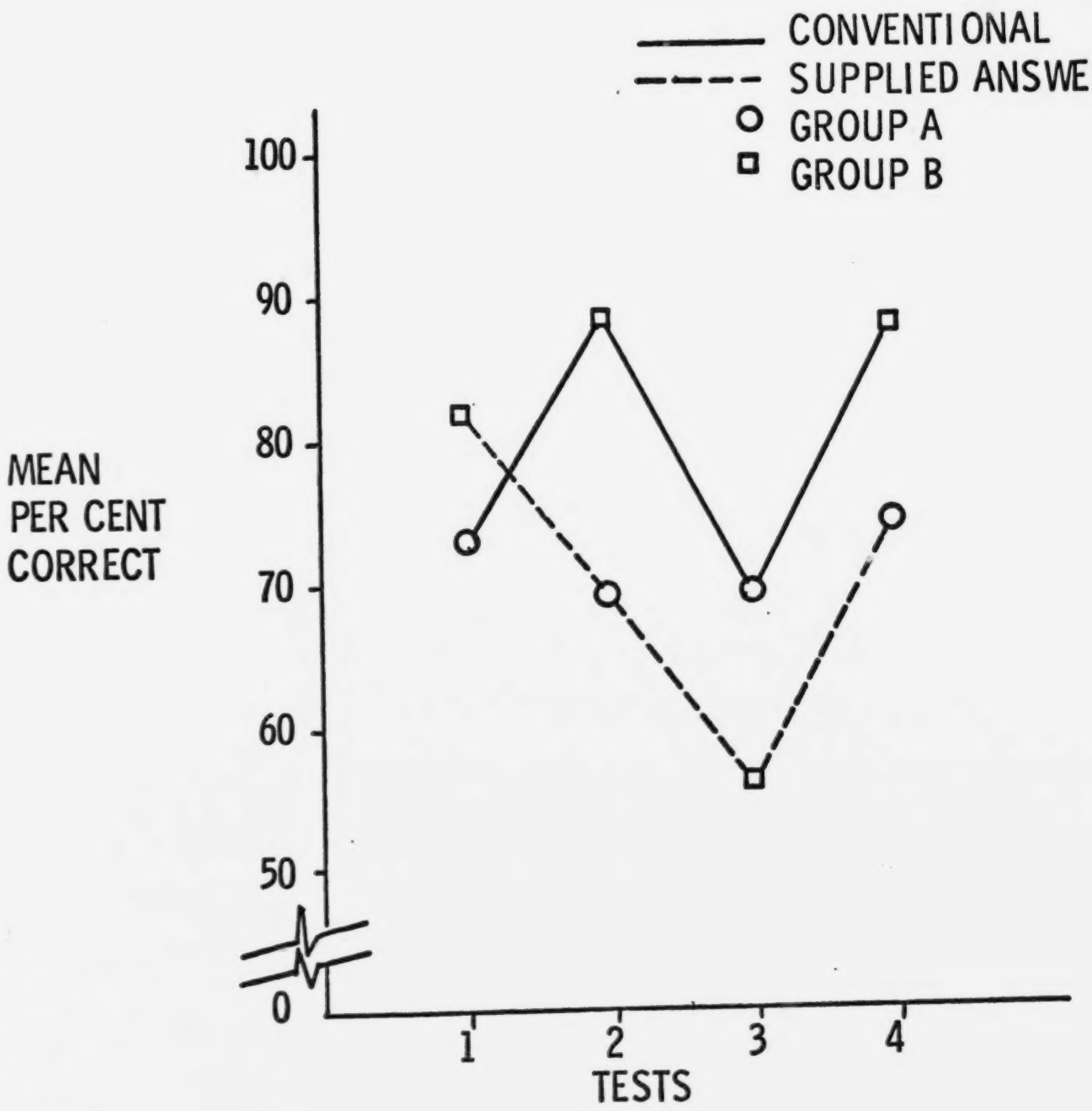
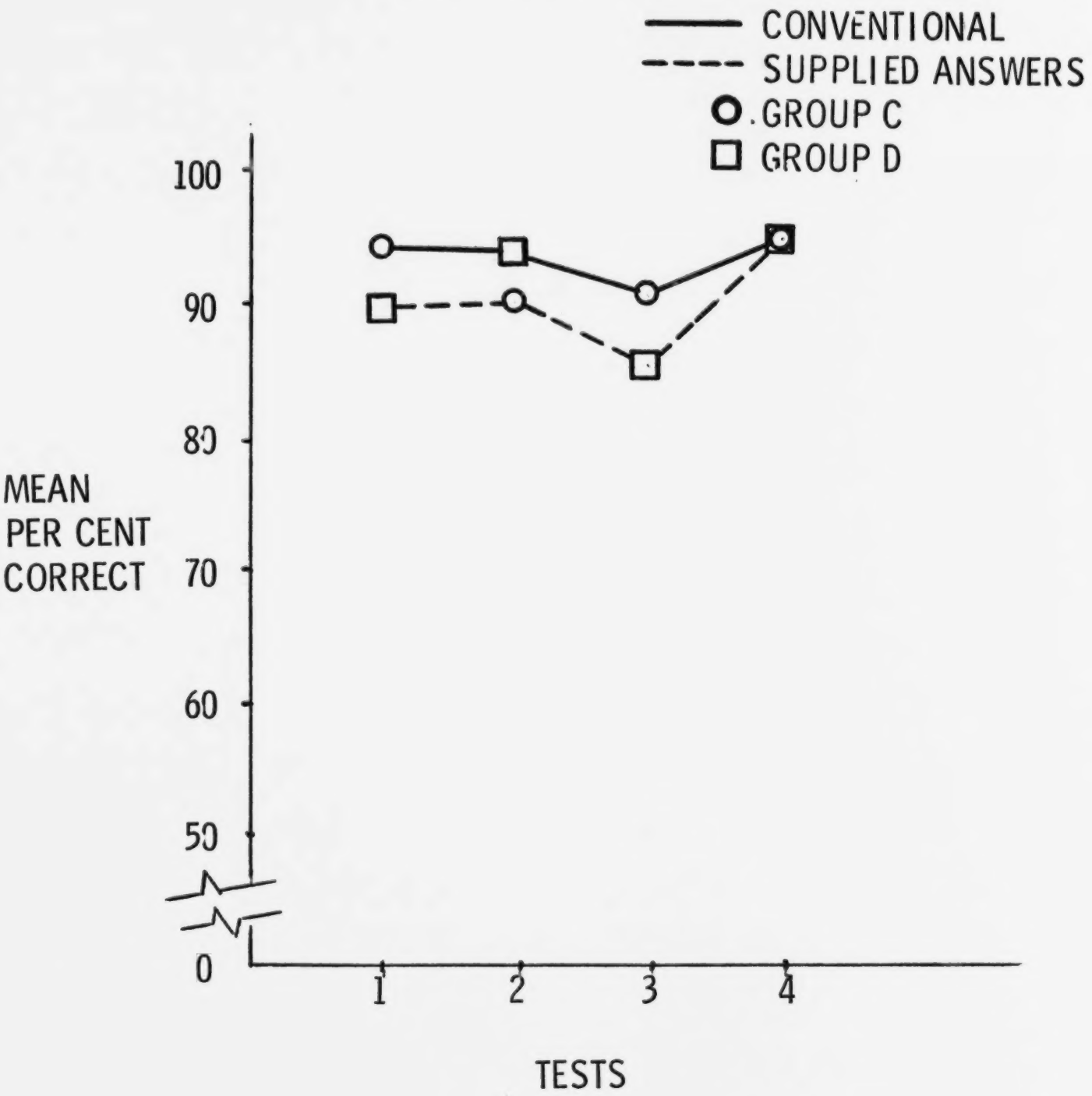


FIGURE 2

COMPARISON OF TEXTBOOK (TB) CONDITION AND SUPPLIED ANSWER (SA) CONDITION ON FOUR TESTS OF RETENTION
(High Ability Group)



three tests the TB means were greater, but on the fourth test the TB and SA means were identical. None of the differences shown graphically approached the .05 significance level. The fifth test means are not shown because once again only two Ss selected to read the last two sets under the SA condition.

Time data indicated that the higher ability classroom averaged 13.6 minutes to read a set under the SA condition and 12.5 minutes under the TB condition.

Comparison between the two classrooms show: (1) that the higher ability classroom consistently achieved higher scores than the lower ability classroom, and (2) that higher ability classroom took slightly more time to read the program than did the lower ability classroom.

Discussion

In this study students were given an opportunity to engage in reading behavior typical of many students: identifying and underlining key portions of printed materials. The results indicate that having students underline what they consider the main points or ideas of a program frame did not result in greater retention than that obtained through the conventional study of the programmed materials.

There were several apparent shortcomings to the underlining process. First, the students did not have a history of underlining or "highlighting" the main ideas. It was new to them and they did not know exactly what to do. Second, they were disturbed when they underlined material and didn't know whether it was the main idea.

As the study progressed the students became less and less concerned with the importance of the word(s) underlined. They appeared to underline anything that looked worthy of underlining regardless of whether the

underlined words reflected the main idea of the frame. This suggests that better results might have been obtained if they were given some evidence of how successful they were in selecting the key word(s). The dilemma here is in determining just what the key word(s) is: is it the word(s) selected by the teacher, by the program writer, or a specialist on learning? On the practical level any knowledge of results would have to be those words selected by the classroom teacher. Regarding such knowledge of results it would be of interest to see if the students' "underlining" behavior could be shaped so that they eventually began selecting the same words as the teacher.

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INCREASING STUDENT EXAMINATION BY PARTIAL PROMPTING OF THE RESPONSE

During the past two years I have made extensive use of programmed materials under group conditions. The procedure has been to flash a program frame upon a screen and then require a student to make the preferred response "out loud" in the presence of the group. If his response was consonant with the immdeiately presented knowledge of results, then it was assumed that his learning behavior was being shaped in part by that subtle form of social acceptance which I chose to label "peer approval."

It was also assumed when the student made his response, that he had read that total program frame. Unfortunately this latter assumption was found false; many students would, after being called upon, examine only enough of the frame to insure their being able to emit the required response. Thus, many students were able to obtain the "peer approval" that presumably attended successful responding by reading only a minimum of the program frame, usually a few words on each side of the blank.

Specialists in programmed instruction have stressed the importance of having Ss read the whole frame in order to respond successfully. Skinner (1965) has said in this regard that "The instruction which occurs as he completes an item comes from having responded to other parts of it." (p. 18) Markle (1964) in her programmed textbook on programming titled Good Frames and Bad said, "An active response to the total frame is obtained from a student when he is required to process all the information in a frame in order to respond." (p. 6)

Research findings of Holland (Holland, 1965; Holland and Kemp, 1965) indicate how little of a program frame need be read in order for S to make a correct response. Using a "black-out" method to obliterate extraneous or nonprogrammed material, he found that no changes in error rate occurred when as much as 69 per cent of the program was obliterated. "Thus only a

third of this material was programmed because only a third served as a basis for answers" (Holland, 1965, p. 84).

Another approach that might be of benefit in the study of existing linear programs is to devise a method which would require S to read and process the whole frame in order to respond successfully. In this paper I would like to describe a pilot project in which I used a unique type of formal prompt. The rationale underlying the process is described below.

If a segment of a word was presented out of context, it is probable that few humans could name the word. For example, probably no one could say what this word is: WASHINGTON but in a context it would be relatively easy: George WASHINGTON. Few people would have trouble making the response, "Washington." The procedure used in this study was to present segments of a word which could not be reported out of context, but was relatively easy after the program frame was examined completely.

The objective of this study was to determine whether Ss reading a program frame would examine the total frame in order to name the prompted word. The word to be prompted and therefore identified by S was determined by me after an analysis of each frame. No effort was made to select the most important or crucial word within the frame; rather, to select a word which I felt would be difficult to identify without an analysis of the total frame.

The amount of prompt to provide was determined by a psychophysical process. The word to be prompted, and which S was to identify, was typed on a small card. Students for whom the program was intended were then shown increased portions of the top of the word until identification thresholds were established. These thresholds showed how much of the word need be presented to be identified in isolation. Using those threshold

exposures to determine the amount of prompt to be presented would mean that many students would be able to identify many of the words without having to examine the total frame. I arbitrarily decided, therefore, to reduce the threshold exposure by one-third. This meant that none of the students would be able to identify the prompted response without examining the context.

Method

Subjects

Ss were students in a sophomore level English class (N = 22) at a university laboratory school. Although the majority of the students were above average both academically and socioeconomically, approximately 15 per cent were from a state-operated soldier's and sailor's school. Previous research with comparable students has shown that they had almost no knowledge of the word roots which they learned through this study.

Materials

The programmed textbook Programed Vocabulary by James Brown (1964) was used in this study. The main reasons for its use were: (1) it has short frames that can be readily placed upon 8 mm film, and (2) its individual chapters are non-cumulative, i.e., the material in any given chapter can be learned independently of other chapters. The individual frames were re-typed and placed on 8 mm film for use with the Technicolor 200 projector. This projector uses economical 8 mm film, allows for single frame exposure, and was the means by which the program frames were presented.

Design and Procedures

The group instructional process alluded to earlier was employed in this study. During the group condition Ss face a screen, upon which are

projected the individual program frames. Using a random list of names, Ss are called upon to make the preferred response "out loud" in the presence of the group. Each S is called upon an equal number of times.

Two group conditions were compared. One condition involved the group presentation of the programmed frames precisely as they appeared in the programmed textbook. The second condition involved the same programmed frames, but altered so that Ss had to respond to the prompted word which I had arbitrarily selected.

The total classroom read Chapter 21 of Programed Vocabulary and were tested over its contents. Using that test as a criterion, similar sexed Ss were paired, and then by a flip of a coin assigned to one of two groups (hereafter referred to as groups A and B).

Both of the above groups, i.e., A and B, were alternately exposed to the two experimental conditions according to the pattern in Table 1. The purposes in alternately exposing the groups to the two conditions were twofold. First, with only 22 Ss it is possible, and probable, that the two groups will not be equal. Alternate exposures to both treatments would provide evidence on the equality of the groups. A second advantage of the across-time alternations is that they permit repeated measures of the two treatment conditions, rather than just one gross comparison at the end of the study.

Each of the chapters in Programed Vocabulary exists independently of the other chapters. In other words S can understand the content of chapter 24 without having read chapter 23. This reduced the dangers in using an across-time analysis, since such an analysis would be meaningless if learning in a given chapter was carried over to subsequent chapters.

Table 1

PATTERN OF EXPOSURE TO TREATMENT CONDITIONS

Chapter	22	23	24	25	26	27	28	29	30
Textbook	A	A	B	B	A	B	B	B	B
Segmented	B	B	A	A	B	A	A	A	A

Table 1 shows the pattern by which Groups A and B read chapters 22 through 30. For reasons mentioned above, study conditions were varied beginning with chapter 24 to provide an assessment of the comparability of the two group treatments.

Immediately upon completion of a chapter, Ss took a short test which measured the factual content of the chapter.

The Ss read three chapters and took three tests every day for three days. Since the class periods were only 48 minutes, it was necessary to move at a rapid rate.

Results

Figure 1 shows the mean for each of the two conditions: the textbook condition in which the blanks in each frame were the same as those in the programmed textbook, and the prompted condition in which the words to which S was to respond were partially covered. Although none of the mean differences approached the .05 level of significance, slightly higher means were achieved when the programmed textbook was used. Only on chapter 26 was the prompted word mean higher than the textbook mean.

Per cent correct responses made during the two study conditions are shown in Table 2. (Although correct responses were recorded for all chapters read during the study, an error in collecting the responses during chapters 22-24 caused them to be excluded from Table 2.)

FIGURE 1

Test Scores for Textbook and
Prompted Word Conditions

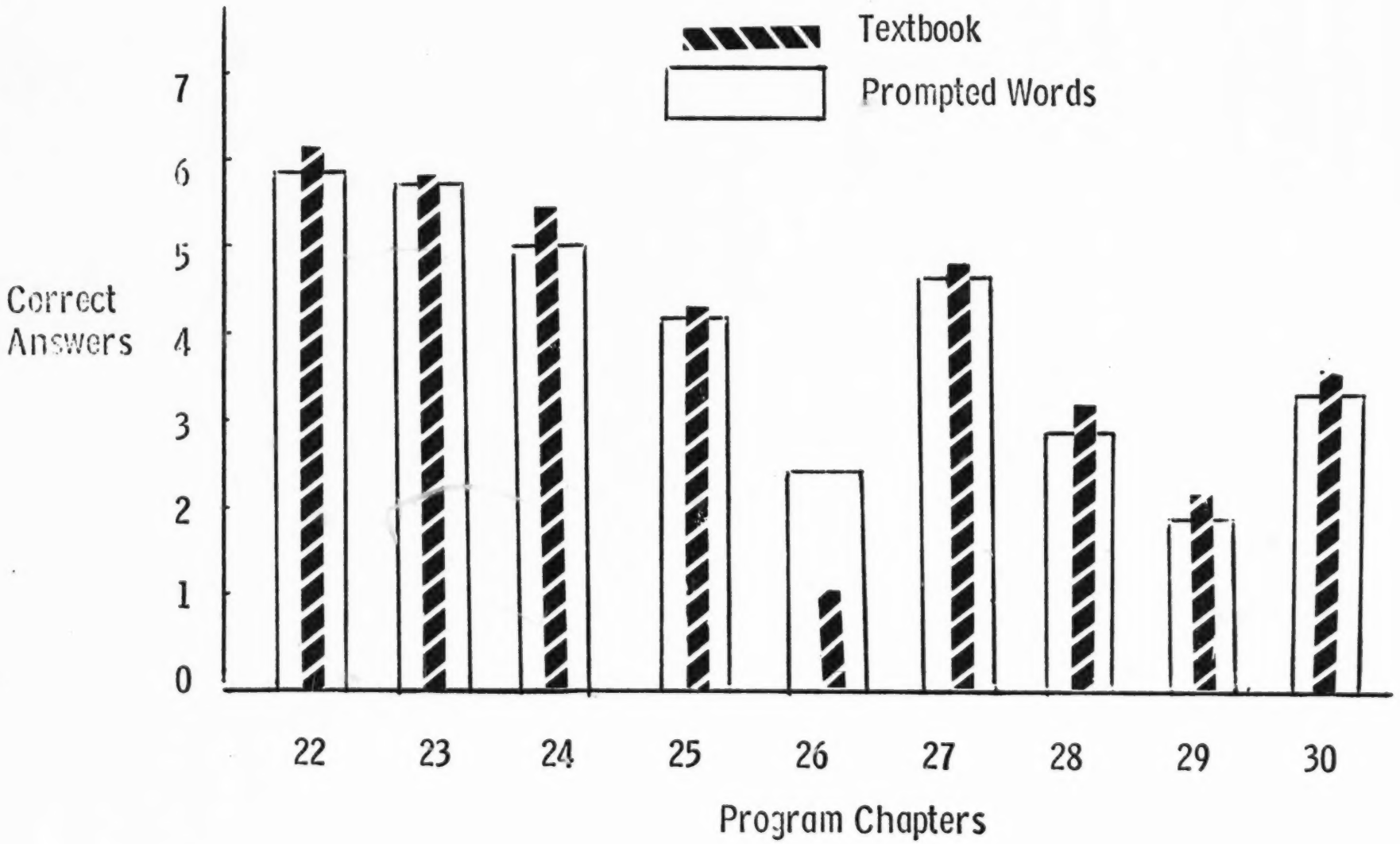

Table 2

PER CENT CORRECT RESPONSES DURING TWO STUDY CONDITIONS

Chapter	25	26	27	28	29	30
Textbook	64	54	63	80	57	66
Segment	50	47	50	62	40	62

The data in Table 2 show that correct responding was greatest during the textbook condition, with the per cent correct being about 15 per cent greater than those occurring during the prompted condition.

Time data were recorded for each chapter and showed only a slight difference in time (less than a minute) between the two conditions. On the average it took ten minutes to read each of the chapters.

A day after the study's completion I met with the classroom of Ss and gave them their total scores. At the same time I asked them to specify which method they preferred. A majority (70 per cent) preferred the prompted condition.

Discussion

Ss read a programmed textbook under group conditions, and were required to respond out loud to the program frames as they were flashed upon a screen.

The results indicated no pronounced differences in retention and program reading time among the two groups as they were alternately exposed to the two treatments.

A subjective evaluation derived from this study and similar pilot projects is that Ss were more attentive to the prompted frames. It appeared that Ss were attempting to solve a problem, for the exposure of the answer frame seemed to sustain their learning behavior in a manner similar to the way the successful solution of a problem does.

Regarding the prompted frames, I was initially concerned that Ss would concentrate on the prompted word and not examine the total frame. During the early portion of the study this was true, but Ss soon stopped doing this and began reading the whole frame. It appeared that they quickly learned that identification of the prompted word in isolation was extremely difficult and, following the path of least resistance, they began examining the frame for the clues to the answer. It also appeared that Ss did more than merely read enough of the frame to get the correct answer; instead, they began reading the whole frame rather than jumping around trying to get clues to what the prompted word really was.

This study suggested another use of prompting which I incorporated in a later study. Rather than prompt the answer on the first exposure of a given frame, I completely covered the word which S was to identify. If S was unable to name the completely covered word, he said "help" and the prompted word was flashed on the screen. This procedure is described in the following series of frames used with a 7th grade science class.

When frame 1 is flashed upon the screen, a given S is called upon to identify the covered word. If he can't name the word he says "help" and receives frame 2 with the prompted answer. Any response made to frame 2, be it right or wrong, is followed by frame 3.

FISH AND CATS AND
SNAILS ARE ALL
[redacted].

Frame 1

FISH AND CATS AND
SNAILS ARE ALL
[redacted]

Frame 2

FISH AND CATS AND
SNAILS ARE ALL
ANIMALS.

Frame 3

It should be added that frame 1 provides a formal prompt in that it tells S the approximate "size" of the answer.

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TEACHING MUSIC FUNDAMENTALS THROUGH THE GROUP USE OF PROGRAMMED INSTRUCTION

In a previous study (Crist, 1967) two methods of learning programmed materials were compared. One method involved the conventional use of a programmed textbook in which the student reads the textbook under individual, self-paced conditions and responds covertly. The second method involved the group use of the same program. Briefly, this condition involved having a whole classroom study together as a group, with Ss taking turns responding "out loud" to the individual frames as they were flashed upon a screen. The results of the above study indicated that retention under the two conditions was similar.

This study was similar to the above study except that a music program was used and the emphasis was upon musical symbols rather than words.

METHOD

Subjects: Subjects (s) were eighteen eighth grade students at a university laboratory school. Sixteen of the eighteen Ss usually attend other schools in the area and it was not practical, and in some cases not possible, to obtain measures of academic ability such as IQ scores. One distinguishing feature of the classroom was the presence of several males who were attending summer school because their parents were dissatisfied with their performance during the previous school year.

In general, the Ss were above average both academically and socio-economically.

Since it was necessary to generate two initially comparable groups, Ss were ranked on the basis of a pretest. That pretest was the same as the posttest which Ss took at the end of the study.

Material: The programmed textbook used in this study was Fundamentals of

Music Theory by Howard Bertrand. The program has six chapters, but only the first two chapters were used in this study. Those two chapters were divided into four segments of approximately equal length. Retention of the material in each segment was measured by tests, each of which contained 25 items. The programmed textbook was re-typed and photographed on 8mm film for use with the Technicolor 200 projector. The projector is cartridge loaded, with each cartridge containing 4000 frames. The projector exposes single frames on command.

Procedure: Two study conditions were investigated, projector and textbook. Under the projector condition, program frames were placed on film and projected onto a screen. Ss were required to read the frames and to take turns responding overtly in the presence of the group. The knowledge of results (KR) was not flashed on the screen until the S called upon emitted a response or said, "I don't know" loud enough for the entire group to hear. In the textbook condition, Ss read the programmed textbook, Fundamentals of Music Theory at their desks at a rate they themselves selected. These Ss were asked not to review the program once they had read the required section.

The groups, Group A and Group B, alternated between the projector condition and the textbook condition as shown in Table 1. While Group A was reading one section in the projector condition, Group B read the same section in the textbook condition. Ss were tested upon the completion of each section.

Table 1

ALTERNATION OF GROUPS TO TEXTBOOK AND PROJECTOR CONDITIONS

Phases	I	II	III	IV
Group A	P	T	P	T
Group B	T	P	T	P

Another source of data consisted of a series of sentence stems which Ss were asked to complete. The following are examples of the sentence stems used: "Reading the programmed book ..." Learning with the projector ...". The sentence stems were used to determine attitudes toward projector and textbook conditions.

For another measure of Ss' attitude toward the two conditions, they were required to answer a scaled questionnaire with 12 items, six of which were negative and six positive.

RESULTS

Table 2 shows the means and standard deviations of Groups A and B on the pretest.

Table 2

COMPARABILITY OF GROUPS ON A 100 POINT PRETEST

Group	M	SD
A	17.2	10.3
B	17.2	11.5

On the pretest, the means for Groups A and B were both 17.2.

Table 3 shows the means, standard deviations, and differences in mean scores on four tests of retention over the two study conditions.

Table 3

PROJECTOR AND TEXTBOOK MEANS ON TESTS OF RETENTION

Tests	1	2	3	4
Items	25	25	25	25
Projector				
Mean	20.2	18.2	19.2	17.8
S.D.	2.2	4.1	3.0	3.3
Textbook				
Mean	20.0	18.1	18.8	15.2
S.D.	2.6	5.1	2.4	5.6
Mean Difference	.2	.1	.4	2.6

On text one the Projector mean was 20.2 (SD = 2.2) and the Textbook mean was 20.0 (SD = 2.6). On text four the Projector mean was 17.8 (SD = 3.3) and the Textbook mean was 15.2 (SD = 5.6). That mean difference of 2.6 was the largest of all four differences.

In summarizing the results on the four tests, Ss studying with the projector had higher means on all four tests than Ss studying with the textbook. Although the means of the projector group were consistently higher, none of the mean differences approached the .05 level of significance.

The posttest was given to determine the amount of retention for the entire two chapters of Howard Bertrand's Fundamentals of Music Theory. The pretest acted as the posttest. Table 4 shows the means on the posttest.

Table 4

MEANS, STANDARD DEVIATIONS, AND t-RATIOS FOR COMPARISON OF PRETEST AND POSTTEST

	Pretest		Posttest		Mean	t-Ratios
	Mean	S.D.	Mean	S.D.	Difference	
Group A	17.2	10.3	70	11.7	52.8	7.81*
Group B	17.2	11.5	65	12.2	47.8	5.60*

*Significant beyond the .01 level.

The mean score of Group A on the pretest was 17.2 (SD = 10.3) and on the posttest was 70 (SD = 11.7). The mean difference was 52.8, which was significant beyond the .01 level. Group B's pretest mean was 17.2 (SD = 11.5) and its posttest mean was 65 (SD = 12.2). The mean difference of 47.8 was significant beyond the .01 level.

READING TIME

In the textbook condition Ss were allowed to pace themselves, while Ss reading in the projector condition all finished at the same time. Time for Projector and Textbook Ss to complete the required sections is shown in Table 5.

Table 5

COMPLETION TIME FOR SUBJECTS UNDER THE TWO STUDY CONDITIONS*

	Phase 1	Phase 2	Phase 3	Phase 4
Projector	40	18	30	17
Textbook	36	26	26	16

*In minutes

The most extreme time difference occurred in section two of the study when the projector mean was 18 and the textbook mean was 26. The smallest mean difference occurred in section four when the projector mean was 17

and the textbook mean was 16.

The mean completion time for each section was 26.2 minutes for the projector condition and 26.0 minutes for the textbook condition.

SUBJECTS' ATTITUDE TOWARD THE TWO STUDY CONDITIONS

The first technique for measuring attitudes was the sentence stem form given to Ss at the completion of the experiment. Responses to the sentence stem form were evaluated by having a disinterested examiner rate and place the completed statements into three categories: positive, neutral, and negative. Figure 4 shows the categories into which the examiner placed the sentences.

Table 6

RESPONSES TO SENTENCE STEMS EXPRESSED AS PERCENTAGES

	Positive	Neutral	Negative
Projector	83	7	10
Textbook	77	5	18

On the sentence stem form subjects responded slightly more favorably to the projector condition than to the textbook condition; 83 per cent to 77 per cent, respectively. The number of negative responses to the projector condition (11 per cent) were less than the number of negative responses toward the textbook condition (18 per cent).

To further assess attitudes, a second questionnaire was given. The raw scores were converted to percentages for the five categories: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD). The questionnaires were presented one week after the end of the experiment. Table 7 and 8 show the statement and the percentage of responses toward each question.

In general, the responses seem to indicate a preference for the

projector condition over the textbook condition. Illustrative of this preference are responses to questions five and six in which "Strongly Agree" responses are zero for the textbook condition and 13 per cent for the projector condition. Responses to question twelve indicate that the group condition was not always the preferred condition. To that question the two conditions were compared with the teacher, and it appeared that Ss were more willing to be left on their own with the textbook than to be placed under group conditions.

In summary, the questionnaire tended to indicate that most Ss felt that programmed materials were interesting and an effective method for studying. It also tended to indicate that the projector condition was more interesting than the textbook condition.

SUMMARY AND CONDITIONS

Summary

It was originally thought that knowing the correctness of one's response was enough to maintain student attention and effort in programmed instruction. Like any textbook, programmed texts with their immediate knowledge of results do not always have the quality of maintaining attention and effort. Students reading both kinds of books can be observed looking intermittently out the window and talking with their neighbors. This study sought to determine the effect of an extra-programmed reinforcer (group approval), in maintaining attention and effort when reading programmed materials.

The findings show that there was not a significant difference in the mean scores on the tests of retention which compared learning under the textbook and projector conditions.

Time data show that there was no significant difference in the

Table 7

STUDENT RESPONSES TO ATTITUDE INVENTORY OF THE PROJECTOR CONDITION*

The statements below represent attitudes toward the use of programmed materials. Symbols used are: SA (Strongly Agree), A (Agree), U (Undecided or Neutral), D (Disagree), or SD (Strongly Disagree).

	SA	A	U	D	SD
1. Classes in which group programmed materials are used are dull and uninteresting.	13	19	19	37	12
2. I feel that using group programmed materials is the most effective method of studying that I have ever used.	19	32	12	25	12
3. I am glad that I am not using programmed group materials in more classes than I am at present.	25	25	31	12	7
4. I do not like to work with group programmed materials.	6	12	12	57	13
5. School would be more interesting if group programmed materials were used in more classes.	13	25	31	6	25
6. I wish that I could study group programmed materials in my other classes.	13	38	13	18	18
7. Using group programmed materials results in too much wasted time.	7	18	12	56	7
8. Using group programmed materials is interesting because you have to keep thinking.	7	43	25	18	7
9. I would rather be working with a group of classmates than working with the group programmed materials.	25	6	32	31	6
10. When I use group programmed materials I can keep interested in my work.	0	31	43	20	6
11. When I use group programmed materials I understand everything that I study.	13	25	25	31	6
12. I would rather have a teacher explain the subject than be left on my own with the group programmed method.	31	12	20	31	6

*Responses are expressed as percentages.

Table 8

STUDENT RESPONSES TO ATTITUDE INVENTORY OF THE TEXTBOOK CONDITION*

The statements below represent attitudes toward the use of programmed materials. Symbols used are: SA (Strongly Agree), A (Agree), U (Undecided or Neutral), D (Disagree), or SD (Strongly Disagree).

	SA	A	U	D	SD
1. Classes in which textbook programmed materials are used are dull and uninteresting.	12	25	20	43	0
2. I feel that using textbook programmed materials is the most effective method of studying that I have ever used.	8	12	43	25	12
3. I am glad that I am not using textbook programmed materials in more classes than I am at present.	18	50	7	25	0
4. I do not like to work with textbook programmed materials.	25	18	20	12	25
5. School would be more interesting if textbook programmed materials were used in more classes.	0	25	32	18	25
6. I wish that I could study textbook programmed materials in my other classes.	0	31	31	13	25
7. Using textbook programmed materials results in too much wasted time.	18	12	14	25	31
8. Using textbook programmed materials is interesting because you have to keep thinking.	8	31	37	12	12
9. I would rather be working with a group of classmates than working alone with a programmed textbook.	25	12	39	12	12
10. When I use textbook programmed materials I can keep interested in my work.	6	43	18	13	20
11. When I use textbook programmed materials I understand everything that I study.	12	12	39	12	25
12. I would rather have a teacher explain the subject than be left on my own with a programmed textbook.	18	18	15	31	18

*Responses are expressed as percentages.

amount of time which Ss took to complete the same materials under the two study conditions.

The findings of the three questionnaires measuring Ss' attitudes indicate the following:

1. The results of sentence stem form reveal that Ss preferred the projector condition to the textbook condition. There were slightly more positive statements made toward the projector condition than toward the textbook condition. Also there were less negative statements toward the projector condition than toward the textbook condition.
2. The questionnaire directed toward the projector condition reveals that Ss responded favorably to this study condition. They felt that the projector condition was interesting and effective. The attitude of the subjects was more in favor of the projector condition than that of the textbook condition. The subjects did not favor the projector condition in the absence of a teacher.
3. The questionnaire directed toward the textbook condition reveals that Ss responded favorably, but not as much as toward the projector condition. They felt that the textbook condition, like the projector condition was interesting and effective. The textbook condition was not preferred to be used in other classes as much as the projector condition. Also the subjects did not favor the textbook condition in the absence of a teacher.

Conclusions

The findings reveal that the projector condition, which involved

the group use of programmed material, is as effective as the textbook condition in small groups. Means on tests of retention support this statement.

The mean difference between the pretest and the posttest reveals that a highly significant change in learning occurred.

Time data reveal no significant difference for the amount of time which Ss needed to complete the programmed materials. This time data emphasizes the potentialities of using group programmed materials in music theory.

Attitude of the subjects toward programmed materials encourage their use as a means of supplementing the more conventional teacher-textbook type of instruction.

RECOMMENDATIONS FOR FURTHER RESEARCH

As a result of this experiment, the following recommendations are made for future research.

1. A similar study should be conducted over a longer period of time to assess the long range effects upon the Ss under the two study conditions, projector and textbook.
2. A similar study should be conducted with a much larger number of Ss.
3. This type of study should be expanded to include other areas of music.

IMPLICATIONS FOR USE IN THE CLASSROOM

1. The projector method of presenting programmed materials is an effective method for maintaining the attention and effort of the student. The projector method, utilizing group approval,

allows the teacher to control the learning behavior of students without the use of aversive controls.

2. The projector method can be used to control the rate of speed that students take to complete a body of knowledge. By controlling this factor all students finish at the same time.
3. In music it would be wise to use the projector in connection with other activites rather than as an isolated activity.
4. The projector method can be used as a related activity to beginning instrumental classes. If the students can be taught the basic fundamentals of music theory before they begin to learn to play an instrument, more time can be directed toward the mechanical problems of the various instruments. This would eliminate the problem of attempting to learn simultaneously musical notation and the idiomatic problems of the various instruments.

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GROUP USE OF PROGRAMMED INSTRUCTION AS A MEANS OF GENERATING HOMOGENEOUS STUDY GROUPS

A major problem attending present-day use of linear programs concerns the inability of students to integrate or synthesize the individual frames. (Thelen, 1964; Eldred, 1965). When a student finishes a programmed textbook, he has been exposed to series of discrete frames enabling him to answer superficial multiple choice questions provided in the publisher's manual. But he has great difficulty answering such questions as: "What is the common concern that relates the purpose of the 13th, 14th, and 15th Amendments?"

Extensive use of existing linear programmed textbooks has convinced the writer that extra-program experiences are necessary if the program's contents are to be used effectively. This is the legitimate domain of the classroom teacher. Unfortunately the individual, self-paced study of programmed textbooks makes it extremely difficult for the classroom teacher to provide extra-program, integrative experiences. The reason can be traced to the differences in reading rate and retention that obtain in the typical classroom: one student is 200 frames ahead of another student but knows little of what he has read, while another student is slowly and diligently examining each frame.

Because of these diversities in performance, the teacher's time and competencies cannot be utilized effectively. Some publisher's manuals say that the differences in student performance are an advantage; they enable the teacher to work with the individual students. This is a naive view since it is doubtful that any teacher is continually going to go from student to student answering the same questions and providing the same instructions and advice. If a teacher is to be maximally effective, it is essential that her competencies be used most effectively. They can

be used most effectively when the teacher provides extra-program experiences that are specific and concentrated. The dilemma in a typical classroom where there is a wide range of abilities is that the teacher has to gear her teaching to the average student. This means that she "loses" the low ability student and "bores" the high ability student. Effective use of the teacher requires that the groups she works with have two characteristics: they must be relatively large and relatively homogenous.

One means by which to solve the above problems attending individual, self-paced usage is to use programmed materials with groups of students. Previous research (Carpenter, 1963; Fry, 1963; Crist, 1967) has shown that programmed materials can be used effectively under group conditions.

An advantage of the group use is that it permits students of comparable abilities to work together. Programs are primarily verbal and a distinguishing feature of students is the way they differ in reading and responding to verbal materials. If groups can be made homogenous, then the speed with which they read and respond will be similar. Research on the group use of programs (Frye, 1963) has shown that heterogenous grouping results in high and low-ability students being out of phase: the lower ability student moves too slowly for the more able student. Frye also found that students tend to perform better when they are aware that they are members of a group having abilities equal to their own.

The objectives of this study were to determine: (1) whether it would be possible, within a single classroom, to identify groups of students sufficiently alike on tests of retention to be labeled "homogeneous," (2) the optimal size of the groups, and (3) other behavioral characteristics of the groups such as error rate and time to read the program.

No attention was given to determining the extra-program experiences that would be needed. Neither was any attention given to ways of altering the learning behavior of any single student or any group of students. In other words the motivational system within the classroom was in no way differentially altered for any student or group.

In a previous study (Crist, 1967) the writer identified a defect attending the group use of programs which this study attempted to remedy. In the group use as he employed it, a programmed frame was flashed upon a screen and a S was called upon to emit the preferred response. When S emitted the preferred response (a response made easy by the low error rate), it was assumed that he had read and responded to all of the material within the frame. This assumption was false; many Ss read the frame only after being called upon and then read only enough of the frame to be sure their response was correct. In many instances this consisted of reading only a few words on each side of the blank.

A secondary objective of this study was to determine whether a unique type of within-frame prompt might reduce the above defect. The method involved in this process will be explained below.

Method

Subjects: One intact junior high school classroom having 27 students was used in this study. Students in the classroom were about average both socioeconomically and academically. The class mean on the California Test of Mental Maturity was 105.2, with scores ranging from 95 to 115.

Material: The programmed textbook Prevention of Communicable Disease was used in this study. The book has 357 frames, some of which contain as many as 75 words.

The Technicolor 200 projector was the means for presenting the

program frames. The projector uses continuous looped 8 mm film and is cartridge loaded. A major advantage is that one cartridge holds 4000 frames of economical 8 mm film. The projector runs continuously like a conventional movie projector, or it can expose one frame at a time as was done in this study.

Prior to being placed on 8 mm film, the complete program was retyped on 3 x 5 cards. Individual frames were kept under 30 words, with average frames having about 17 words. All of the original program's preferred responses were typed into the frame. No efforts were taken to make the preferred responses demanded by this study congruent with those required by the original program.

As a first step each retyped frame was carefully read, after which a word was selected which it was felt would be one of the most difficult words in the frame to identify when it was completely blanked out. No effort was made to select the most important or necessary word, but rather, the word that it was felt would be the most difficult word for the S to identify. Several factors made the selection of a difficult word in itself a difficult task. The nature of the language provides strong prompts. Also, the same words tend to be used frame after frame. and Ss quickly become aware of this. In some instances it was extremely difficult to select a word that S would have difficulty in identifying. When this occurred, it was expected that the behavior of reading the total frame would be well enough established so that Ss would still read the total frame. Each frame was first presented with the difficult-to-identify word completely covered. Without some type of prompt, such a series of frames would be essentially a series of test items. Therefore, each frame was presented a second time, with the second presentation providing a prompt consisting of the top 25% of the word. Following this prompted frame the customary knowledge of results was presented. For

increased clarification of the process, one frame will be presented completely. It should be emphasized that this frame exists in a certain context and that the preferred response is not as difficult as it might appear. This is especially true if the S has been reading and examining those frames that precede the one identified here.

FRAME 1

ANTITOXINS ARE A TYPE OF
ANTIBODY THAT ACTS AGAINST
THE [redacted] FORMED BY SOME
MICROORGANISMS.

FRAME 2

ANTITOXINS ARE A TYPE OF
ANTIBODY THAT ACTS AGAINST
THE [redacted] FORMED BY SOME
MICROORGANISMS.

FRAME 3

ANTITOXINS ARE A TYPE OF
ANTIBODY THAT ACTS AGAINST
THE POISONS FORMED BY SOME
MICROORGANISMS.

Frame 1 is flashed upon the screen, and a given S is called upon to identify the completely covered word. If he cannot identify the word, he says "help" and frame 2 is flashed upon the screen. Any response made to frame 2, be it right or wrong, is followed by frame 3. It should be added that frame 1 provides a prompt in that it tells S the "size" of the answer.

Throughout the study records were maintained of each S's responses, making it possible to assess: (1) the difficulty Ss had in identifying the completely covered word, and (2) the extent to which they were able to utilize

the prompts.

Procedure: The programmed textbook Prevention of Communicable Disease was divided into 13 independent sections. Each section was similar in length and covered a particular area of communicable diseases. After a given section of the program was completed by a given group, that group of Ss would immediately take a test. The tests were non-cumulative and did not attempt to assess material learned in previous sections.

Table 1 shows the types of groups and corresponding sections of the program studied under a specified group condition. For the first four sections of the program, all class members were placed together into one group. Using total points on tests 1 through 4 as the sole criterion, Ss were placed into

Table 1

Size and Structure of Groups (N=27)

Tests	1,2,3,4	5,6,7,8	9, 10,11	12, 13
Type and No. of Groups	One Large Group	Three Homo Groups	Three Heter. Groups	Two Homo. Groups

three "homogeneous" groups: top third, middle third, and bottom third. Each "homogeneous" group worked together in different sections of the same science room. These three groups studied the programmed sections assessed by tests 5, 6, 7, and 8. After completion of test 8, Ss were ranked on the basis of total points obtained on tests 1 through 8 and assigned to one of three "heterogeneous" groups. These groups were formed by taking the top three Ss and randomly assigning each S to one of three groups. Then the next three Ss were randomly assigned to one of the three groups. This process was continued for the whole

class until three "heterogeneous" groups were formed. Those "heterogeneous" groups studied the materials covered by tests 9, 10, and 11.

Points on the eleven tests were totaled and Ss were again ranked. For the final phase of the study the class was divided into two "homogeneous" groups. Those ranked in the top half formed one "homogeneous" group and those in the bottom half formed the second group. Learning under those conditions was measured by tests 12 and 13.

Results

During the initial phase of this study the tatal classroom studied together as one group. Learning during that phase was assessed by tests 1, 2, 3, and 4. Using scores on those tests as a criterion, Ss were divided into top, middle, and bottom thirds. The performances of those three groups are shown in Table 2 and presented graphically in Figure 1. On test 5 the mean for the top third of the class was 6.17, for the middle third the mean was 4.57, and for the bottom third of the class the mean was 1.43. On test 13, the final test, means and standard deviations of the top and middle groups were

Table 2

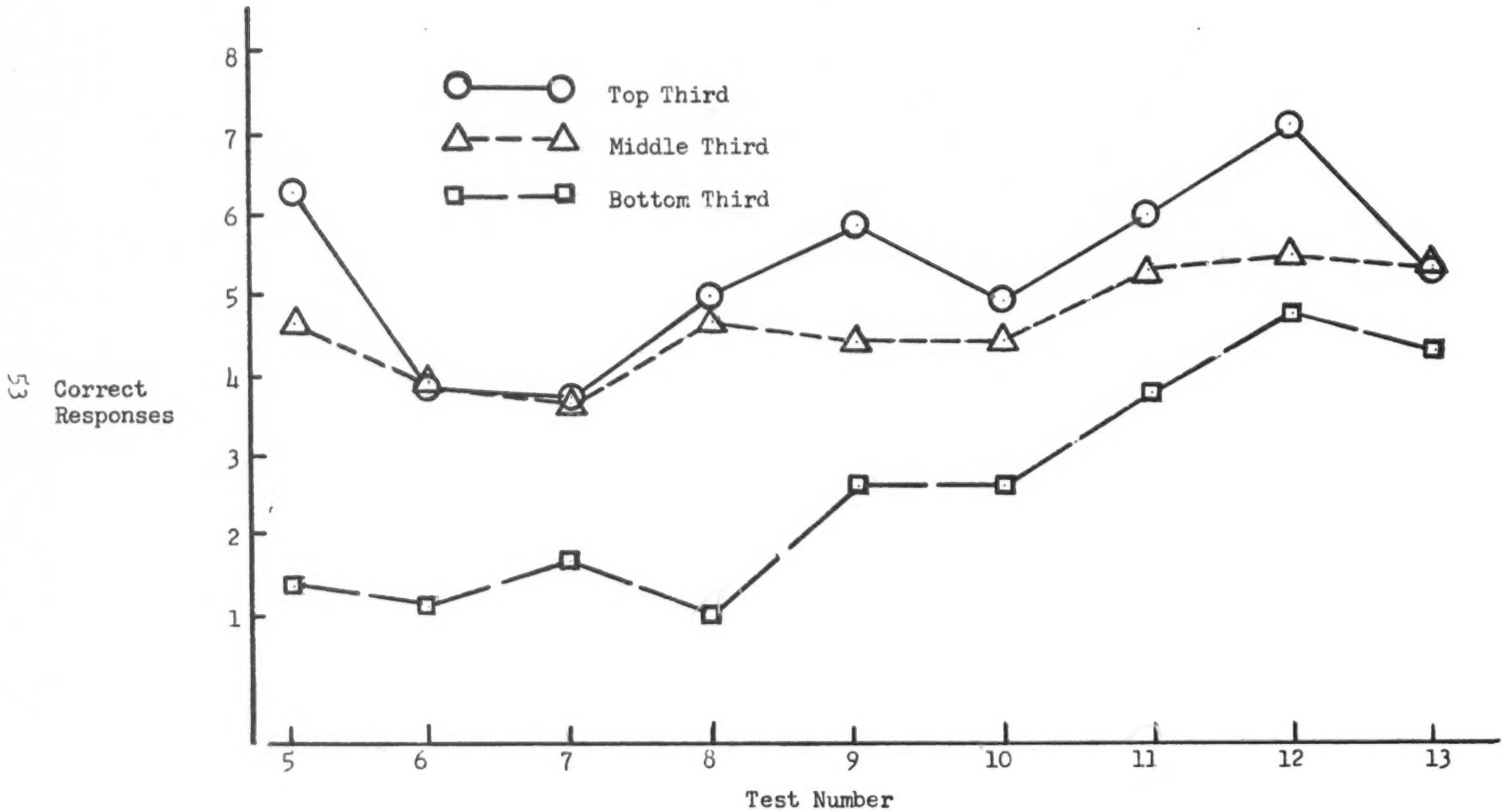
Means and Standard Deviations for the Three Groups of Ss

Test No.	5	6	7	8	9	10	11	12	13
Top Third	6.2	3.9	3.8	4.6	5.9	4.9	6.0	7.1	5.4
SD	1.5	1.0	1.4	2.5	1.1	0.8	1.0	1.3	0.5
Middle Third	4.6	3.9	3.8	5.0	4.3	4.6	5.3	5.5	5.3
SD	1.5	0.8	1.4	2.1	1.6	0.9	1.3	1.2	0.7
Bottom Third	1.4	1.1	1.7	1.0	2.6	2.7	3.8	4.9	4.3
SD	1.2	0.6	1.0	1.0	1.0	1.0	1.4	0.8	1.2

almost identical, while the bottom group had a lower mean and a greater standard deviation.

Figure 1

Group Means on Tests 5-13



There are two salient features of the data in Figure 1. First, the differences between the top and bottom group were fairly consistent. This is evidenced by the fact that the top group mean was always greater than that of the bottom group.

A second feature of the data in Figure 1 is the similarity in performance of the top and middle groups. On two tests (the 6th and 7th) the middle group's mean was equivalent to that of the top group.

Throughout the study each S was called upon to respond in the presence of his group. If S was unable to identify the frame's blank word, a prompt was provided in the form of the top 25% of the blanked word. There were three responses an S could make: he could request "help" and then use the prompt to make the preferred response, or he could be incapable of making the preferred response even in the presence of the prompt.

Records of Ss' responses are shown in Table 3. The first column shows the percentage of correct responses by each group when the preferred response was completely blanked out. The top one-third of Ss correctly identified 37% of the completely covered words, while the bottom third could identify those

Table 3

Ss' Uses of Partial Prompt

Group	Blank Only	Partial Prompt	Incorrect Responses
Top Third	37	52	11
Middle Third	33	45	22
Bottom Third	17	60	23

words only 17% of the time. The middle column shows how Ss responded when the preferred response was prompted by allowing the top 25% of the answer word to be

exposed. The bottom third required that prompt frequently and 60% of their correct responding was made in the presence of the prompt.

The third column shows the percentage of Ss who were not able to respond correctly even when the prompt was evident. (It should be added that Ss could take all the time they wanted to examine the frame and prompt.) The top third responded incorrectly (or not at all) on 11$ of the frames. The middle and bottom groups responded incorrectly 22% and 23% of the time, which was twice as great as the top group's error rate.

At the end of the study Ss took a test over the total program. There were 29 items on the test. Table 4 shows scores made by the same three groups of Ss identified in Table 3. Individual scores are presented to show the degree of homogeneity i.e., test similarity, within the groups. Three scores are excluded because those Ss were absent over 50 percent of the time, another is excluded because he was absent and could not be reached to take the final test, and a fifth S transferred to another school during the study.

The final column in Table 4 shows the medians of the three groups. Medians of the top and middle groups are 27 and 23.5, respectively. Both differ from the bottom group median of 16. Although there is an overlapping

Table 4

Scores by Ss on the Final Test

	Subjects Ranked Highest to Lowest								
Group	1	2	3	4	5	6	7	8	Mdn
Top	28	28	28	27	26	24	23		27
Middle	26	25	25	24	23	23	23	23	23.5
Bottom	26	17	16	16	15	13	12		16

among the scores of Ss in the top and middle group, only S-1 in the bottom

group has a score greater than that obtained by several Ss in both of the upper groups. It is difficult to account for S-1's score on the final test. On all the previous tests his scores resemble those of other Ss in the bottom group, and coppying or cheating on the final test was almost impossible.

Data in Table 4 do suggest that if the group technique were continued, it would be possible to establish two similar groups: one composed of the 16 highest scoring Ss and a second composed of the six lowest scoring Ss.

Time data: The study lasted a total of 13 days. Each daily session began within two or three minutes of the school bell and lasted until the dismissal bell rang 45 minutes later. In other words, Ss read the programmed material for approximately 40-45 minutes a day, with each daily session punctuated by a test.

Time records for individual groups were maintained. They indicate that the top, bottom, and middle groups took similar amounts of time to finish a given segment. It is probable that any time differences that did occur could be traced to the projector operators rather than the groups, since the projector operators had to call on Ss, evaluate and record their responses, as well as operate the projector.

Discussion

This study and others dealing with the group use of programs have exposed several defects. The major defect is that the group use allows only one S to respond at a time. The basic premise surrounding the group use is that having a S respond out loud in the presence of the group will maintain his behavior. But while one S is responding the others are physically passive. If those passive Ss have no interest in learning the subject or getting a good grade, then that passivity is not correlated with an assumed covert responding. Instead, the physical passivity is correlated with daydreaming and similar intellectual peregrinations.

When a S is called upon to respond, he usually wants to be sure his response is correct. Because of this he invariably takes a relatively long time to respond. During the interval other Ss squirm in their chairs or turn and look at the responding S. It was, of course, a desideratum of the group use that such peer pressures would maintain each S's attention and presumably shape his learning behavior. Unfortunately the responding S tended to use too much time, and the whole process was excessively slow and frequently boring.

Interviews and questionnaires leave little doubt that the group pressures operated on all Ss. These pressures seem to have a benign influence on the most able students in that they generate intra-group competition. The able students worked hard and were excited about trying to determine the blanked response.

A major problem attending the use of programmed materials is reflected in the following anecdote. In a previous study the group technique was used with a classroom of students who were the lowest level students in the school. There were 22 of them and they were placed together in one classroom so that they wouldn't disrupt the "normal" classrooms. The program used with them had been found fairly effective with more capable students in the same school, so I thought it might be well to test its effect upon the school's lowest ability group.

The results were quite shocking. When a frame was flashed upon the screen, the responding S said "I don't know: and put his head back on his desk. None of the students had any interest in the program or the process and were completely indifferent to peer pressures. Ten minutes of this behavior was intolerable and I attempted to introduce a system of reinforcements. One reinforcer acceptable to student and teacher was Indian wrestling, a physical activity in which one student pins the arm and hand of the second

student.

The students were told that they could Indian wrestle another student as soon as the group made 20 correct responses. Classroom behavior changes were incredible. Everyone was alert and those who responded incorrectly were berated by others. This method was effective for two 25 minute periods, but the customary intellectual ennui returned as soon as one student had defeated everyone in the class. Efforts were given to identify and use other reinforcers, but none was available. Because a return to the regular, non-reinforced condition was a waste of time, I terminated the group use of programs with that classroom.

The group use can reduce some of the boredom which has characterized the study of a programmed textbook, but it is no antidote against the lack of interest possessed by academically apathetic students who care little for books, grades, or 'self-imporvement."

There is no teacher more naive than the one who thinks he can effect a significant change at all abilities levels primarily through the use of programmed textbooks or any other existing educational devices. I am convinced that anyone who intends to effect such changes in American education must first of all give considerable attention to techniques by which to maintain the learning behavior.

Programs are still a source of great aid to student and teacher. For example, the well thought out, orderly arrangement of material in a program is a splendid initial source for anyone who wants to learn a new subject matter. But when they are introduced into the classroom, the teacher must not forget to give equal, nay greater, attention to some reinforcing consequences. If there are none, or if the student is not interested in those that come available when he finishes the program, then there will be no perceptible alterations in the classroom status quo. Those eager for a good grade will put

out the effort necessary to get that grade. Those for whom a good grade means nothing will display their customary apathy and indifference. With the latter the teacher will have to bring into play all of his readily available punishments: poor grades, ridicule, threats, and loss of approval.

The main objective of this study was to determine whether the group use of programmed materials would aid in creating and identifying "homogeneous" groups of students. If such homogeneous groups could be identified, then the classroom teacher could plan extra-program experiences for groups of students rather than for individual students.

The results indicate that homogeneous groups, i.e., groups with similar retention scores, could be identified through the techniques employed in this study. But these groups could not be artificially generated by doing such things as dividing the total classroom into three equally sized groups. The size of the groups must be dictated by the ability levels of the students within the classroom. In this study's classroom there was a definite consistency in the performance of individuals Ss, and only one S gave evidence (on the final test) that he should possibly have been interacting with the top one-third of Ss rather than the bottom third.

Subjects were given 13 tests and a final comprehensive test. The scores on the first four tests would have been reliable predictors of how each S would perform throughout the study, with the exception of the single S identified above.

The consistency in student performance reported in this study is the type that normally obtains in a classroom when only programmed materials are introduced and no efforts are made to otherwise alter the motivation and learning of students. The distressing feature of existing programs is that there is no discernible change in individual behavior when they

are introduced into the classroom.

It is platitudinous to say that learning is determined by the effort and attention expended by the student, but it seems to be a fact users of programmed materials fail to take into consideration. If you want to introduce changes when programs are used, then you must give comparable attention to finding a motivational system which will alter the status quo. No one would want to intentionally arrange conditions so that the less able students learn more than those who historically have been the more competent. No one wants to generate "horse-race" conditions in which one group of students is pitted against another group. What teachers and educators want is to alter the behavior of the less able student so that learning is a positive activity, an activity which the less able can find rewarding. For them learning is basically aversive, and the introduction of programs doesn't alter their behavior.

If a "horse-race" type of competition pitting student against student is not desired, then what changes do teachers and educators want to see affected? Simply, they want to see <u>every</u> student interested and attentive and, most important of all, expending the effort necessary to learn. I am saying that they will not see this learning behavior being emitted by every student merely be introducing programmed materials into the classroom.

Of all the positive features assigned to programmed instruction, the one that fascinated educators was the opportunity for each child to move at his own rate. Of what value is it to a student to move at his own rate if the consequences that follow are of little or no value. It was inevitable that the amalgamation of a low achieving, uninterested student and a linear programmed textbook would create no serious alteration in that student's learning behavior. The result of this unfortunate confluence of student and program has been a disenchantment with programmed materials. Programmers shared in this

disenchantment by intimating that knowledge of results were sufficiently powerful reinforcers to maintain each and every student's learning behavior.

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